

## TWO NEW SPECIES OF JUSTICIA (ACANTHACEAE) FROM THE RÍO BALSAS BASIN OF MICHOACÁN, MEXICO

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**ABSTRACT.** Two new species of *Justicia*, *J. huacanensis* and *J. lucindae*, are described from the Infernillo region of the Río Balsas basin in southern Michoacán. Brief discussions about Acanthaceae in the Balsas basin and putative relatives of these species are provided.

The drainage basin of the Río Balsas in southern Mexico comprises approximately 112,320 square kilometers in the states of Guerrero, Jalisco, México, Michoacán, Morelos, Oaxaca, Puebla, and Tlaxcala. It is an east-west oriented region located between the crest of the Transvolcanic Axis to the north and the crest of the Sierra Madre del Sur to the south. Due to high levels of diversity and endemism, Rzedowski (1978) treated the lower elevations of this area as the Balsas Depression Floristic Province. Fernández et al. (1998) applied a strictly geographical definition for this region that included the entire watershed of the Río Balsas. They listed 4,442 vascular plants as occurring there. These included 79 species of Acanthaceae. Some of the names on their list refer to species that likely do not occur in the region (e.g., *Aphelandra madrensis* Lindau, *Jacobinia leucothamna* Standl., *Justicia alopecuroides* T. F. Daniel, and *Louteridium rzedowskii* T. F. Daniel) or are synonymous with other names listed (e.g., *Henrya ortegana* Happ = *H. insularis* Nees ex Benth., *Tetramerium hispidum* = *T. nervosum*, *Ruellia occidentalis* = *R. nudiflora*, and *Carlownrightia costaricana* Leonard = *C. arizonica* A. Gray). Numerous other species have been reported from the region (e.g., *Aphelandra lineariloba* Leonard, *Carlownrightia hintonii* T. F. Daniel, *C. mcvaughii* T. F. Daniel, *Henrya tuberculospema* T. F. Daniel, *Holographis hintonii* (Leonard) T. F. Daniel, *Justicia brandegeana* Watsch. & L. B. Sm., *J. hilsenbeckii* T. F. Daniel, *Odontonema cuspidatum* (Nees) Kuntze, *Poikilacanthus capitatus* (Leonard) Ramamoorthy, *Ruellia chilpancingana* T. F. Daniel, *R. guerrensis* T. F. Daniel, *R. pringlei* Fernald, *Stenostephanus harleyi* (Watsch.) T. F. Daniel, *Tetramerium langlassei* Happ, *T. tenuissimum* Rose). Although a thorough study of Acanthaceae in the Balsas basin has yet to be completed, the total number of species there likely approaches 100.

Rodríguez-Jiménez et al. (2005) listed 337 species of vascular plants as endemic to the Balsas basin, including three acanth: *Aphelandra verticillata* Nees ex Hemsl., *Justicia zopilotesensis* Henr. & Hiriart, and *Ruellia fruticosa* Sessé & Moc. In fact, at least nine additional species of Acanthaceae are endemic there: *Holographis argyrea* (Leonard) T. F. Daniel, *Ruellia cedilloi* Ramamoorthy, *Stenandrium manchonense* T. F. Daniel, *Tetramerium butterwickianum* T. F. Daniel, *T. emilyanum* T. F. Daniel, *T. glutinosum* Lindau, *T. ochoterennae* (Miranda) T. F. Daniel, and the two species described

below. If the revised numbers for Acanthaceae suggested here are representative of other large families, then the numbers of species both present in and endemic to the region are higher than previously reported.

The hottest and driest portion of the Balsas basin occurs in the Infiernillo region of southern Michoacán and adjacent Guerrero. This region is centered around the Presa Infiernillo, a reservoir resulting from the damming of the Río Balsas just downstream from its confluence with the Río Tepalcatepec. A general description of the area is provided by Guevara-Fefer and Rzedowski (1980), who note that it is a particularly important center of endemism within the Balsas basin. Due to access limitations, the portion in Guerrero has been almost completely ignored with regard to biological exploration; however, the portion in Michoacán is better known. It is particularly rich in Acanthaceae; we have documented 35 species there. Five of these appear to be endemic to the Infiernillo region: the two species of *Justicia* herewith described, *Tetramerium butterwickianum*, an undescribed species of *Justicia*, and an undescribed species of *Tetramerium*. This number represents nearly one-half of Acanthaceae endemic to the entire Balsas basin. Other recent and significant collections of Acanthaceae from this region include *Holographis hintonii* (Leonard) T. F. Daniel and *Ruellia pringlei* Fernald (Daniel 2005), as well as *Poikilacanthus novogalicianus* T. F. Daniel (*Steinmann 3408* at CAS), a species previously known only from the type locality in Colima.

The two species described below appear to be related to a group of taxa from western and southern Mexico with red, conspicuously funnelform, and moderately long (20–45 mm long) corollas. This assemblage includes *Justicia candicans* (Nees) L. D. Benson, *J. palmeri* Rose, and *Jacobinia roseana* Leonard (a combination for this species in *Justicia* has not been proposed; indeed, it remains unclear whether it should be treated as distinct from *J. candicans*). All of these taxa also have five more or less equal calyx lobes and glabrous capsules 7–16 mm long. A larger group of *Justicia* with similar corollas, but with variation in the number and/or relative sizes of the calyx lobes and in the length and pubescence of the capsules includes: *J. adenothyrsa* (Lindau) T. F. Daniel, *J. cuicatlanana* T. F. Daniel, *J. hians* (Brandege) Brandege, *J. novogaliciana* T. F. Daniel, *J. oaxacana* (Greenm.) T. F. Daniel, *J. paucifolia* T. F. Daniel, and *J. stellata* (B. L. Rob. & Greenm.) T. F. Daniel. Like both species described below, all other species in this larger assemblage have 2-aperturate pollen with two or three rows of insulae on each side of the aperture. Species in this assemblage have been affiliated with Graham's (1988) related sections *Plagiacanthus* (Nees) V. A. W. Graham (e.g., *J. candicans*) and *Sarotheca* (Nees) Benth. (e.g., *J. hians*). Putative phylogenetic relationships among these species are not yet known, and the extent to which some or all of them comprise one or more monophyletic lineages within *Justicia* probably will be addressed most effectively by molecular phylogenetic studies.

***Justicia huacanensis*** T. F. Daniel & V. W. Steinm., sp. nov.—TYPE: MEXICO, Michoacán: Mpio. La Huacana, along MEX 37, 5.2 km SE of Cupuancillo, above highway on SW slopes of Mesa La Lima, ca. 18°48'00"N, 102°05'00"W, 450 m, tropical deciduous forest, 24 Nov 2002, V. Steinmann 3024 (holotype: IEB!; isotype: CAS!).

Fig. 1.

Frutices usque ad 2 m alti. Folia petiolata, laminae ovatae vel ovato-ellipticae, 15–75 × 10–33 mm. Dichasia pedunculata e foliorum axillis orta. Bracteolae deltatae vel cordatae, 10–22 × 10–18 mm. Calyx 5-lobus, lobis lineari-ellipticis vel oblanceolatis, 4–4.5 mm longis. Corolla coccinea, 24–35 mm longa, extus pubescens trichoma-

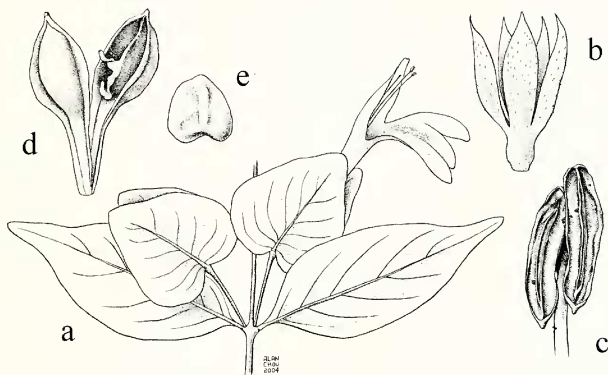


Fig. 1. *Justicia huacanensis* (Steinmann 3024). a. Node with pedunculate dichasia, bracteoles, and a flower,  $\times 1.6$ . b. Calyx,  $\times 5$ . c. Anther,  $\times 12.5$ . d. Capsule,  $\times 3.4$ . e. Seed,  $\times 4.5$ .

tibus eglandulos. Stamina thecis 2–2.3 mm longis, subparallelis, subpariter insertis, basi calcaratis vel inconspicuo calcaratis. Capsula 10–13 mm longa, glabra. Semina laevia.

Shrubs to 2 m tall. Young stems subterete to quadrate, nearly glabrous to 1- or 2-fariously pubescent, trichomes retrorse or antrorse, 0.2–0.6 mm long. Leaves petiolate, petioles to 8 mm long, blades ovate to ovate-elliptic, 15–75 mm long 10–33 mm wide, 1.8–2.3 times longer than wide, (acute to) acuminate at apex, subattenuate to rounded-acute at base, margin entire, surfaces nearly glabrous to pubescent with eglandular trichomes (mostly or entirely along major veins). Inflorescence of prominently bracteolate dichasia in leaf axils; dichasia alternate or opposite at nodes, 1–3 per axil, 1–2 (or more?)-flowered, pedunculate, peduncles 4–20 mm long,  $\pm$  2-fariously or evenly pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.1–0.2 mm long. Bracteoles ovate to deltate to cordate, 10–22 mm long, 10–18 mm wide, abaxial surface pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.2 mm long, trichomes concentrated along (or restricted to) proximal portion of midvein, secondary bracteoles (if present) much reduced. Flowers subsessile. Calyx 5-lobed, 5.5–6 mm long, lobes linear-elliptic to oblanceolate, narrowed basally, 4–4.5 mm long, 1–1.5 mm wide, abaxially sparsely pubescent with antrorse to antrorsely appressed eglandular trichomes 0.05–0.2 mm long. Corolla scarlet-red, 24–35 mm long, externally pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.4 mm long, tube 15–23 mm long, 2.5–3 mm in diameter near midpoint, gradually expanded distally from near base, upper lip 9–13.5 mm long, apically 2-lobed, lower lip 12–13.5 mm long, lobes 5–6 mm long, 3.5–4.4 mm wide. Stamens 13.5–18 mm long, filaments puberulent proximally and glabrous distally, thecae 2–2.3 mm long, equal in size, subparallel, subequally inserted, glabrous, lacking basal appendages or with an inconspicuous basal appendage to 0.1 mm long; pollen (Fig. 2) 2-aperturate, apertures flanked on each side by 2 rows of insulae, exine reticulate. Style 23–25 mm long, glabrous; stigma 0.2 mm long, lobes not evident. Capsule 10–13 mm long, glabrous, head

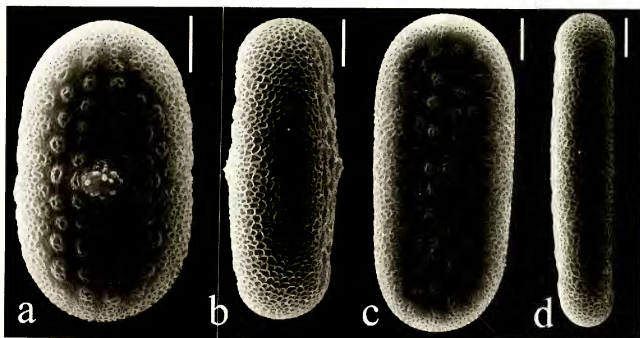


Fig. 2. Scanning electron micrographs of pollen. a–b. *Justicia huacanensis* (Steinmann 3024). a. Apertural view. b. Interapertural view. c–d. *Justicia lucindae* (Steinmann 1699). c. Apertural view. d. Interapertural view. Scales = 10  $\mu$ m.

subspheric to subellipsoid, stipe 5 mm long. Seeds plano-convex to concavo-convex, sublenticular, 2.6–3 mm long, 2.8–3 mm wide, surface smooth, lacking trichomes.

Phenology. Flowering: July–November; fruiting: November.

Distribution (Fig. 3). Known only from south-central Michoacán where plants occur in tropical deciduous forest at elevations from 300 to 750 m.

**PARATYPEs.** **Mexico.** MICHOCÁN: Mpio. La Huacana, Jabalin, Los Ciriancitos (Ejido Lázaro Cárdenas), 18°42'52"N, 101°58'57"W. *H. Rendón C. 151* (IEB); Mpio. La Huacana, ca. 3.5 km WSW of Los Ranchos, ca. 18°41'30"N, 102°02'40"W, 300 m, 8 Nov 2003. *V. Steinmann 3865* (IEB, CAS); Mpio. La Huacana, ca. 2 km ENE of Los Ranchos, along ridge top of Cerro El Barril, 18°42'35"N, 102°00'00"W, 750 m, 27 Sep 2003. *V. Steinmann & E. Carranza 3557* (IEB, CAS).

This species appears to have affinities with Graham's (1988) section *Plagiacanthus*. The most conspicuous and distinctive feature of *J. huacanensis* is the presence of large, ovate to deltate to cordate bracteoles that subtend the flowers. Variation among the known collections is rather minimal.

The specific epithet refers to the municipality of La Huacana in Michoacán, where all of the collections have been made.

**Justicia lucindae** T. F. Daniel & V. W. Steinm., sp. nov.—**TYPE:** MEXICO. Michoacán: Mpio. Arteaga, along road to Infiernillo, 17.5 km SE of jet. with Mex. 37, 18°25'32"N, 101°54'30"W, ca. 325 m, tropical deciduous forest, 24 Jun 2001, *V. Steinmann 1699* (holotype: IEB!; isotype: CAS!). Fig. 4.

Frutices usque ad 2 m alti. Folia sessilia vel subsessilia (petioli usque ad 0.5 mm longi), laminae ovatae vel ovato-ellipticae vel subcordatae, 9–39  $\times$  8–27 mm. Dichasia sessilia e foliorum vel bractearum axillis orta, spicam terminalem usque ad 20 mm longam formantes. Bracteolae lineares, 4.7–6.5  $\times$  0.5–0.7 mm. Calyx 5-lobus, lobis lineari-ellipticis, 4–4.9 mm longis. Corolla roseo-rubra, 25–30 mm longa, extus pubescens trichomatibus eglandulosis et glandulosis. Stamina thecis 1.3–1.6 mm longis, subparallelis, subpariter insertis, basi ecalcaratis vel inconspicuo calcaratis. Capsula 8–9.5 mm longa, glabra. Semina tuberculata.

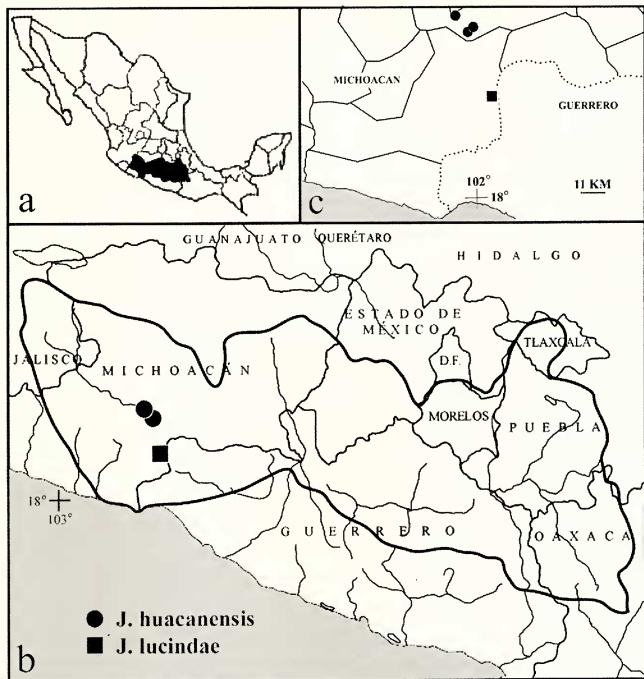


Fig. 3. Río Balsas Basin and distributions of *J. huacanensis* and *J. lucindae*. a. Mexico showing location of drainage basin of the Río Balsas (based on Fernández et al. 1998). b. Outline of the Balsas Basin (based on Fernández et al. 1998) with species distributions. c. Portion of southern Michoacán (showing boundaries of municipalities) and western Guerrero with species distributions.

Shrubs to 2 m tall. Young stems subterete to subquadrate, internodes glabrous or (evenly to) 2-fariously pubescent with erect to flexuose eglandular trichomes 0.5–1 mm long and branched (often arachnoid) eglandular trichomes 0.1–0.5 mm long, trichomes (if present) sometimes restricted to distal portion of internodes, nodes pubescent with straight to flexuose eglandular trichomes to 1.2 mm long. Leaves sessile to subsessile, petioles to 0.5 mm long, blades ovate to ovate-elliptic to subcordate, 9–39 mm long, 8–27 mm wide, 1.1–1.9 times longer than wide, rounded to subacute at apex, rounded to truncate to subcordate and sometimes  $\pm$  amplexicaulis at base, margin entire, adaxial surface glabrous or sparsely pubescent with branched-arachnoid trichomes along midvein, abaxial surface sparsely to densely pubescent with cauline type trichomes along midvein (and sometimes along secondary veins as well). Inflorescence of relatively short sessile to pedunculate terminal dichasiate spikes to 20 mm long (including peduncle, if present), peduncles (if present) to 8 mm long, glabrous, rachis glabrous, often without significant internodal elongation; dichasia

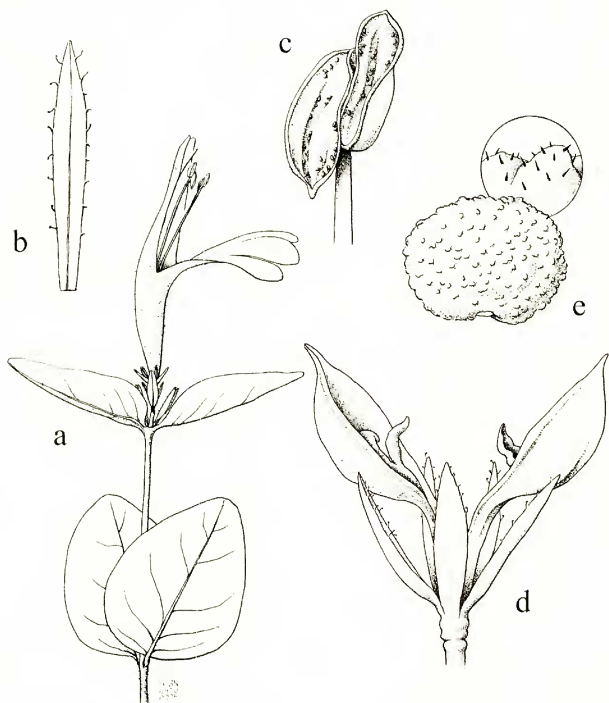


Fig. 4. *Justicia lucindae* (Steinmann 1699). a. Distal portion of shoot with inflorescence and flower,  $\times 1.9$ . b. Bracteole,  $\times 8.3$ . c. Distal portion of stamen with anther,  $\times 20$ . d. Calyx and capsule,  $\times 6$ . e. Seed ( $\times 10.9$ ) with enlargement of tubercle ( $\times 98$ ) showing trichomelike projections.

opposite, sessile, 1-flowered, 1 per axil, subtended by a leaf (i.e., proximalmost pair of dichasia sometimes subtended by distalmost pair of leaves, and thus spikes sessile) or bract. Bracts elliptic to linear-elliptic to oblanceolate, 6.5–9 mm long, 1.1–3 mm wide, abaxial surface glabrous or very sparsely pubescent with glandular trichomes like those along margin, margin ciliate with erect to flexuose glandular trichomes 0.1–0.9 mm long (glandular-pubescent). Bracteoles linear (to linear-oblanceolate), 4.7–6.5 mm long, 0.5–0.7 mm wide, abaxial surface glabrous or pubescent like bracts. Flowers sessile to subsessile. Calyx 5-lobed, 5–6.5 mm long, lobes linear-elliptic, 4–4.9 mm long, 1–1.5 mm wide, abaxial surface glabrous (rarely with few scattered glandular trichomes), margin glandular-pubescent (and often with an understory of eglandular to subglandular trichomes to 0.05 mm long as well). Corolla pink-red, 25–30 mm long, externally pubescent with flexuose eglandular and glandular trichomes 0.1–0.4 mm

long, tube 15–19 mm long, gradually expanded distally, 2–2.6 mm in diameter near midpoint, upper lip 11–15 mm long, apically 2-lobed, lower lip 10–12 mm long, lobes 6.5–7 mm long, 2.2–3.7 mm wide. Stamens 11–13 mm long, filaments glabrous, thecae 1.3–1.6 mm long, equal to subequal in size, subparallel, subequally inserted (overlapping by 1–1.2 mm), glabrous, lacking basal appendages (or with inconspicuous basal appendages to 0.1 mm long); pollen (Fig. 2) 2-aperturate, apertures flanked on each side by 2 rows of insulae, exine reticulate. Style 24–29 mm long, glabrous; stigma 0.2 mm long, lobes not evident. Capsule 8–9.5 mm long, glabrous, head subspheric to subellipsoid, stipe 3.5–4 mm long. Seeds sublenticular, 2.5–3.2 mm long, 2.5–3 mm wide, surfaces covered with subconic tubercles (especially along margin), tubercles covered with minute trichomelike projections.

Phenology. Flowering: June; fruiting: June.

Distribution (Fig. 3). Known only from a single locality in southeastern Michoacán where a few dozen plants occur along a small ravine in tropical deciduous forest at an elevation of about 325 m.

This species appears to have affinities with Graham's (1988) section *Plagiacanthus*, from which it differs most noticeably by its tuberculate (vs. smooth in sect. *Plagiacanthus*) seeds. Among Mexican *Justicia*, *J. lucindae* can be distinguished by the combination of its sessile to subsessile leaves, linear bracteoles 4.7–6.5 mm long, pink-red corollas, and minute trichomelike projections on the seminal tubercles.

The epithet of this species honors Lucinda McDade (b. 1953), our friend, colleague, and first teacher of systematic botany (Steinmann). Her molecular studies of Acanthaceae have greatly advanced our understanding of relationships in the family.

## ACKNOWLEDGMENTS

We are grateful to Alan Chou for preparing the illustrations of species and Scott Serata for assistance with scanning electron microscopy. Steinmann's studies were supported by a grant from the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad to the Instituto de Ecología, A.C. (account number 902-03).

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